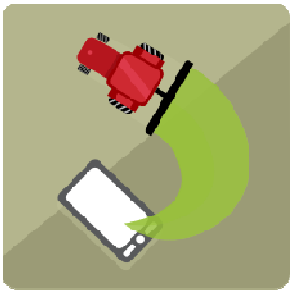
USER MANUAL



for **MachineryGuide** GPS guidance system

MachineryGuide V1.3.0 user manual

June 2015

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Introduction

Precisional farming is more and more widepsread in Europe. Its popularity is mostly due to the aim of making agricultural operations more effective, precise, andof increasingthe crop's quality. It is becoming more and more important for the farmers to do agricultural works as economically as possible, by using modern technology. Due to this fact, there is an increasing interest in GPS guidance systems, which gives proper accuracy with the help of satellites (SBAS-system), that cover different areas and transmit free correctional signs.

MachineryGuide GPS guidance system is newcompared to similar devices, since the software was made for Android operating systems, so it is an application that can be used on a smartphone. Its suitability to be used in precisional farming provides an 10 Hz antenna, which receives GLONASS and GPS signs, and uses free SBAS (EGNOS, WAAS) corrections. This antenna communicates with the device via Bluetooth in the form of NMEA-messages. The system's optional accessory can be a 7" tablet which later on could be used for personal use.

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About the guidance system

Parts of the system:

1. GPS/GLONASS antenna
2. GNSS Bluetooth receiver, DC-USB cable
3. 2xUSB car charger
4. micro USB cable
5. tablet windshield mount
6. Android device (not included)

- MachineryGuide Android application (software)

USB car charger

The USB charger supplies the GNSS-receiver and the tablet.

Features:

- 2 x 5V
- 2 A / output

Device holder

Tablet windshield mountfor tablet with display size 7”-11”.

With suction cup the tablet can be mounted to the windshield of the agricultural machine easily.

DC-USB cable

DC-to-USB cable, which provides power to the Bluetooth GPS-receiver.

The cable has 2.1mm DC plug.

Antenna

The antenna has to be mounted on top of the agricultural machinery. It is very important to mount it tothe highest point of the machine, and must not be obscured. It is essential for the proper pass to pass precision.

Specifications:

- Frequency: 1575MHz ~ 1615MHz
- VSWR : 1.3 @ 1580MHz
- Bandwidth : 43MHz
- Plarization : RHCP
- Antenna gain: 27dB
- Size : 37.5mm x 34.5mm x 12.5mm
- Connection : SMA
- RF cable : RG174, 2.5m
- Magnetic bottom

Bluetooth receiver

The receiver is supplied with 5V DC voltage via the USB cable.
The tablet/smartphone is connected to the receiver via Bluetooth interface.
The external GPS antenna receiver can be connected to the Bluetooth-receiver with SMA connector.
The device provides position data with 10 Hz update rate, the data connection in the form of serial NMEA messages.

Specifications:

- Uses GPS, GLONASS, SBAS, QZSS signals
- 1 ~ 10 Hz update rate
- Position accuracy 2.5m CEP
- Velocity accuracy 0.1m/sec
- Warm start TTFF under open sky 29sec average
- Cold start TTFF under open sky 30sec average
- Cold start sensitivity -148dBm
- Tracking sensitivity -165dBm
- Bluetooth version: 2.0
- Bluetooth device name: MG BT-REC-V1.0

Installation instructions

1. Plug-in the USB car charger into the socket
2. Mount the tablet windshield mount onto the windscreen of the agricultural machine (It is recommended to slightly wet the suction cup before clipping it, and to clean the windscreen under the suction cup.)
3. Put the tablet into the silicone case.
4. Mount the tablet into the holder.
5. Put the GNSS-receiver into the cabin (you can fasten it with screws or double-sided glue tape)
6. Connect the tablet to the charger using micro USB cable.
7. Connect the GNSS-receiver to the charger using DC-USB cable.
8. Connect the GPS-antenna to the receiver.
9. Put the antenna onto the roof of the agricultural machine.

Software installation

Internet connection is needed for downloading and activating the application.

Installation steps:

1. The software (APK file) can be downloaded from website machineryguideapp.com, from the following link: machineryguideapp.com/en/releases
    a. It is recommended to reach the website directly from your tablet/smartphone, since this way the APK file is installed rightaway when tapping the download link.
    b. When the installation file (APK file) is downloaded to your computer, copy the file to your Android device. For this,connect your device to the computer as a media device with a USB-cable.

    Note:
    Since MachineryGuide app is outside of official Android marketplace, to install the APK first go to Settings, scroll down to Security, and select Unknown sources.

2. After installation, activate your software. Click on ”Licence” button, then write in your 6-digit code given by your distributor. (In case of purchasing only software, the code will arrive by email, in case of purchasing hardware too, the code will be in the product’s box)
3. After writing in the code, in the main window the ”Licence” button will change to ”Start” button and you will be able to use the software without any restrictions.

Software updates

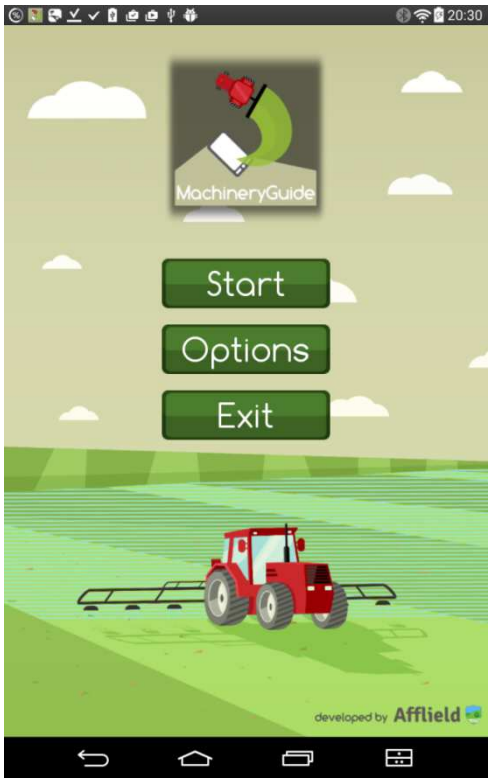
Software updates are available on this link:machineryguideapp.com/en/releases. The Installation steps of software updates are very similar to the first installation, except for the Activation step, which only has to be done once, at the beginning.

In case of new release, each user will be notified via e-mail. (The e-mail is sent to the e-mail address which was given at registration).

First steps

Instructions of usingMachineryGuide guidance application.

Main window



There are only three buttons in the main window.

If the program has not been activated, instead of the ”Start” button the ”Licence” button will be seen. (About the activation you can read below.)

By tapping the ”Options” button you can configure your software.

By tapping the ”Exit”button you can close the application.
If you have started a job session, before closing it the program will ask if you want to save the session’s data.

Options:

You can customize the application with several setting functions.

Each setting is saved automatically, so you do not have to set the desired parameters every time.

Units:

- Supported units:

  Length

  Meter, Feet, Inch, Yard

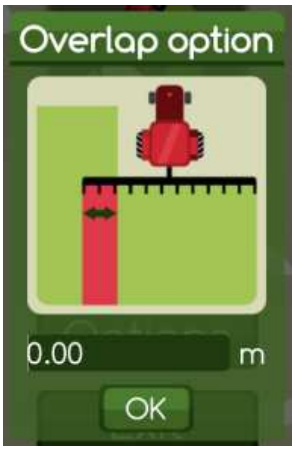
  Speed

  Kilometer/hour, Mile/hour

  Area

  Hectare, Square miles

Overlap



You can set the width of the allowed overlap.

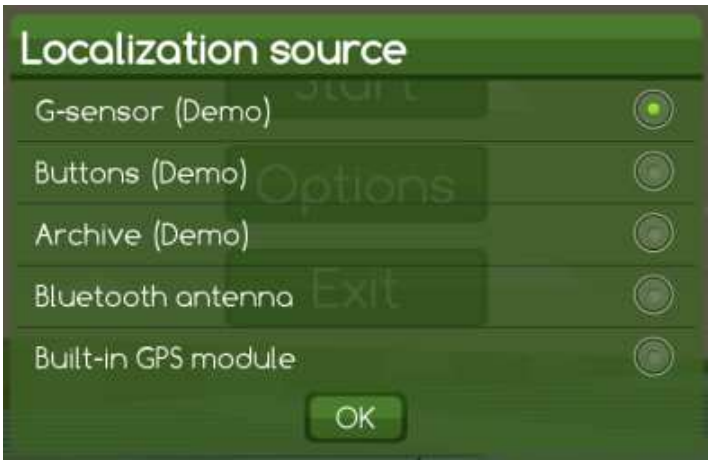
The distance between the navigation lines are calculated based on the values given here.

Gauges

You can set which measurements you would you like to see on the navigation screen while guidancing.

Choosable data: speed, done path, cultivated area.

GPS-source



Real work is provided by the built-in GPS-module and the Bluetooth-antenna options.

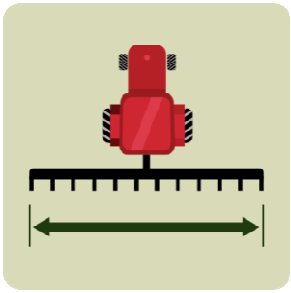
For presentation or testing, the other sources can be chosen.

Job handling

For each job session you can save several parameters, which you can check anytime later on.

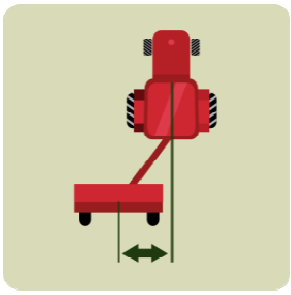
For continuing a job session you can find and load in the saved path based on the data given here.
Adjustable parameters: address, customer, agriculture type, description, employee, date. If you would like to continue a former job, tap ”Continue former job” tab and choose the session you would like to continue.

Size and Alignment



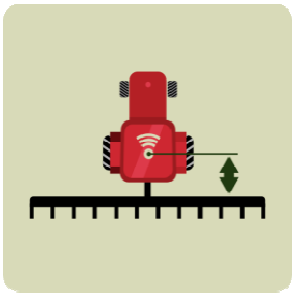
Setting workwidth:

- With the parameter given here you can set the workwidth of the agricultural machine.(The software sets the width of the line (stripe), which indicates the cultivated area. The navigation distances are also calculated based on this data.)
- Negative number cannot be given.



Setting center-offset

- For negative value you can move the outline of the cultivated area to the left of the agricultural machine. For positive value you can move it to the right of the agricultural machine.
- center-offset is not considered when calculating the navigation path (not supported when guidancing)

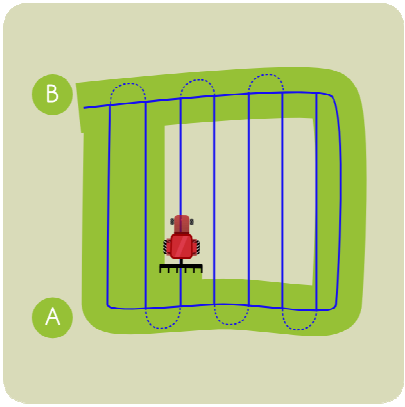


Setting the distance of the antenna

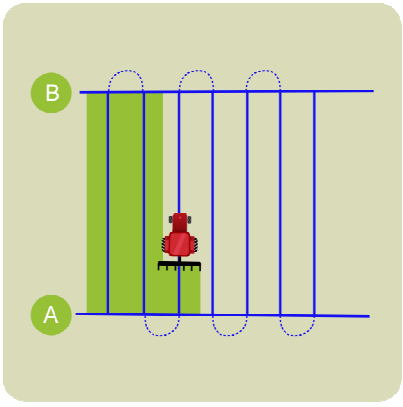
- With the parameter given here you can set the distance of the antenna from the agricultural device.

  The software does not support towed machines with joint.

Guidance mode



Mode 1 (A-B with surrouding): First go around the area, then give points A and B, based on which, the program outlines the A-B reference straight, and the straights that are parallel to it. You will have to move on these straights while guidancing.



Mode 2 (A-B Straight): You give points A and B based on which, the program outlines the A-B reference straight and the straights that are parallel to it. You will have to move on these straights while guidancing.

Language

You can set the language of the operating system. The chosen language will be the language of the program as well.

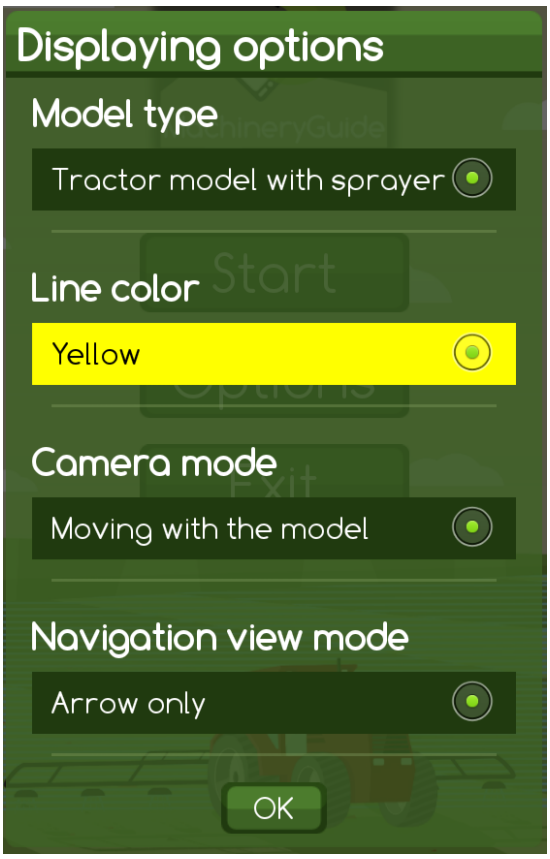
Supported languages:

- English
- Estonian
- Hungarian
- Russian
- Spanish

Font size

You can choose the font size of the operating system. The chosen size will be the font size of the program as well.

Display



You can customize the display of the program.

Model type: You can decide what would you like to see on the screen: a tractor model with a sprayer, a tractor without a sprayer, or simply an arrow.

Line color: You can choose with what color you would like to indicate the cultivated areas.

Camera mode: you can choose from two modes:

1. Camera moves along with the tractor (follows the moving of the tractor)
2. Camera is fixed, looks only in one direction.

Navigation view mode:

1. Navigation bar
2. Navigation arrow
3. Arrow + navigation bar

Starting a new job session (In case of Bluetooth-receiver)

Steps of starting a job session:

1. Start the program
2. Set the parameters that are necessary to start guidancing.
    a. setting workwidth
    b. setting center-offset
    c. setting the distance of the antenna
    d. setting guidance mode
    e. setting the allowed overlap
3. Select GPS-source to the Bluetooth-antenna inthe settings menu.
4. Tap”Start”.
5. To start the job session, the Bluetooth-device needs power supply, that is, it has to be plugged into the USB car charger, which needs to be under power.
6. After tapping ”Start” button the following window appears onthe screen:

*In the window choose the ”*MG BT-REC-V1.0” *device.*

7. After choosing the following window should appear:

In the program the job session can immediately be started, as soon as position data are available, independently from their accuracy.

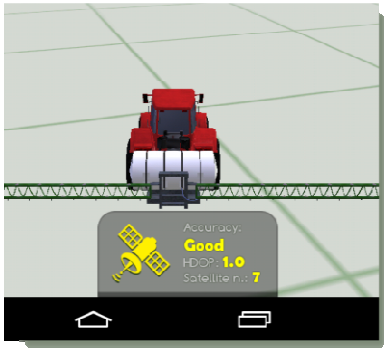
On the Navigation screen a small icon and caption give information about accuracy.

Accuracy levels: Bad (Red sing)

Weak (Orange sign)

Good (Yellow sign)

Excellent (Green sign)



8. In the appearing window you can give the data of the job session in the interest of simpler searching later on.

For starting a new job session you do not need to give any of the data. It is advised to give the location though, for simpler retrieving later on.

9. For moving further tap the ”OK” button. The following summary of the given data appears. After tapping the ”OK” button the new job session will start.

New job has been created
Address: Example address
Description: -
Customer: -
Employee: -
Agriculture type: Spraying
Date: 12/8/2014
OK

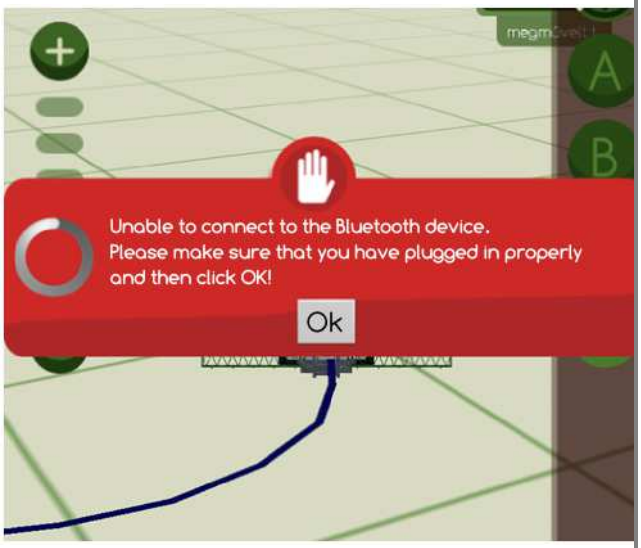
Error messages and notifications when using the Bluetooth-antenna

Many notifications inform the user of the software about errors occuring while using the Bluetooth GPS-receiver. This way, if the accuracy of the antenna decreases below the minimum level, the user of the program can wait for more accurate data to be received. Or if the cable of the antenna is unplugged, the user can react immediately to the problem occured.

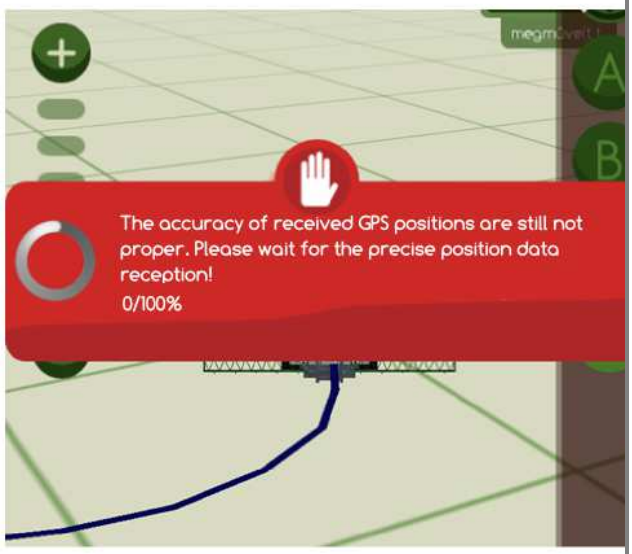
Sources of error messages:

1. Bluetooth connection is cut-off (possible cause: the power supply of the Bluetooth-receiver is unavailable, that is, the USB-cable or the car charger is unplugged)
2. There has been no new information about the position within a certain amount of time.
3. Accuracy needed for precisional guidancing has ceased (its cause: the antenna sees less satellites due to a higher landmark, or the Horizontal Dilution of Precision (HDOP) has increased)

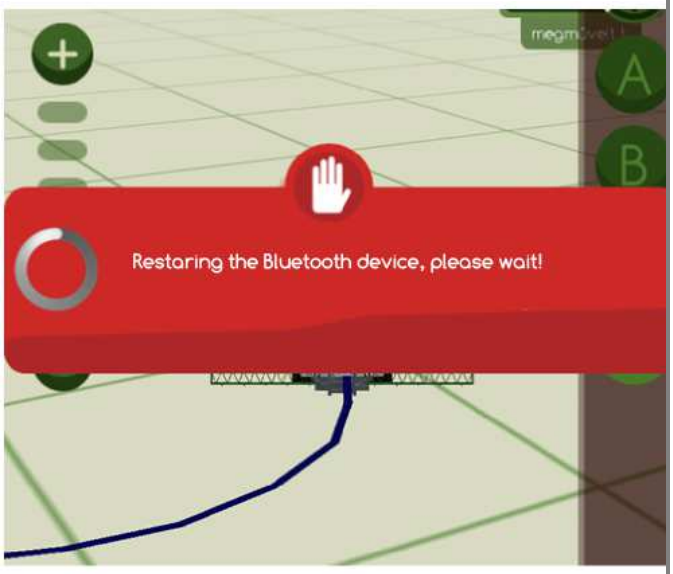
1. **Warning:** Bluetooth-connection is interrupted and the automatic reconnection has failed. Check if the cables of the receiver are properly connected, then tap ”OK” and select the paired GPS-receiver.

Alarm in main menu	Alarm in navigational window
	

2. **Warning:** Receiving accurate coordinates has ceased. Wait for the needed accuracy to be reached

Alarm in main menu	Alarm in navigational window
	

3. **Warning:** Bluetooth-connection restarting.If the software does not receive more position data in a certain time, or if there is a problem with Bluetooth communication, the program restarts the connection automatically.

Alarm in main menu	Alarm in navigational window
	

Starting new job session (In case of built-in GPS-module)

Steps of starting a job session:

1. Start the program.
2. Set the parameters necessary for starting guidancing:
    - **a.** setting workwidth
    - **b.** setting center-offset
    - **c.** setting the distance of the antenna
    - **d.** setting guidance mode
    - **e.** setting allowed overlap
3. Choose the built-in GPS-module in the ”GPS-source settings”
4. Tap ”Start” button.
5. To start a job session, the Built-in GPS-module has to be turned on.
6. After tapping”Start” the following window appears. Wait until the pop-up window disappears.

While waiting for GPS-reception all functions of the program are blocked. The program behind the dialogue window indicating waiting is darkened. You can interrupt the progress anytime by tapping the tablet’s/phone’s ”Back” button.

7. In the following window you can give the data of the job session for earlier retrieving later on.

For starting a new job session you do not have to give any data, although it is recommended to give the location for easier retreiving later on.

8. Tap”OK”. The following summary of the given data appears. After tapping ”OK” the new job session starts.

Path reloading

When reloading a path, you can load in data of areas roved or cultivated earlier.

Warning! Due to the fact that the positional data given by free corrections have low absolute accuracy, there might be a difference between the loaded and the actual positions.

Steps of route reloading:

1. Start the program.
2. Inthe main menu tap ”Start”.
3. As soon as the initialization of the GPS’s position reception is done, the following window disappears:

4. Tap ”Continue former job” tab.

5. The former job session, that you want to load in, you can choose from this list. The sessions are listed based on starting dates and locations. For more information tap the icon to the right of the item. Here you can check all the given parameters.
6. To start loading, tap ”OK”.

Managing earlier paths

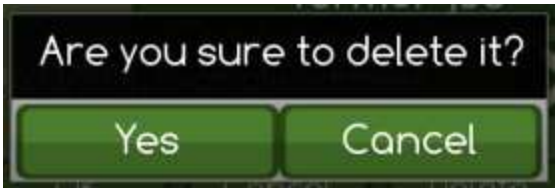
For viewing data of earlier rovedpaths, or deleting paths, go through steps 1-6 described inthe previous chapter.

Viewing detailed information:

In the appearing window there is an icon to the right of each item of the list. By tapping it, you can view detailed information of the given session:

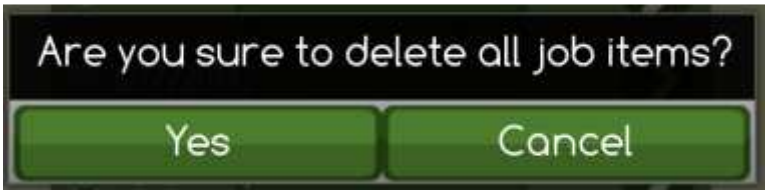
Deleting a job session:

To delete a session, tap the icon right to the item you want to delete and tap ”Delete”. Deleting happens only if you confirm it by tapping ”Yes”:



Deleting all jobb sessions:

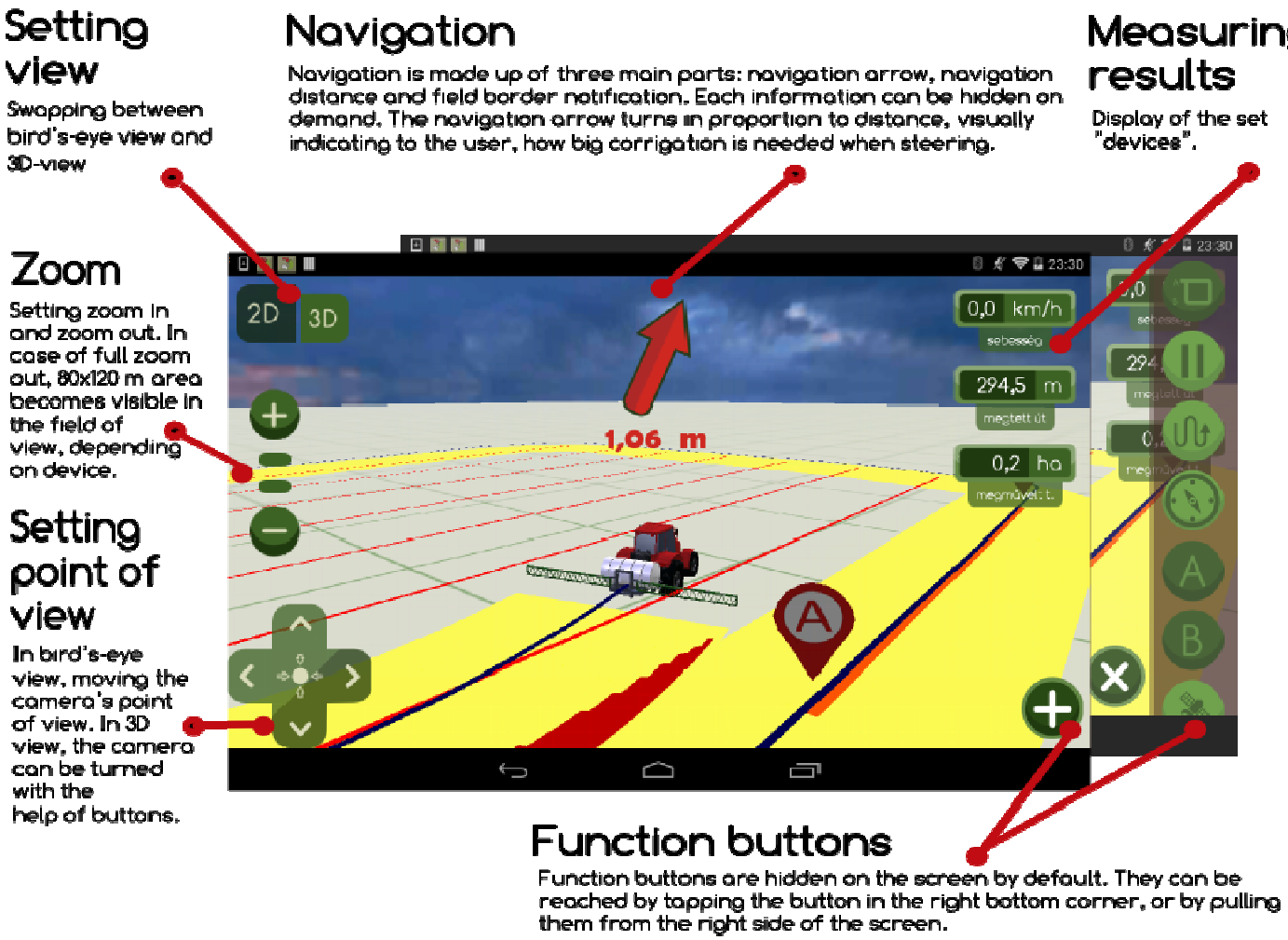
You can delete all job sessions by tapping ”Delete all” of the ”Continue former job” tab of ”Job handling” window. Deleting happens only if you confirm it by tapping ”Yes” inthe pop-up window.



Functions available in later versions:

- *displaying statistics of the given path (done path, cultivated areas, average speed, duration of cultivation etc.)*

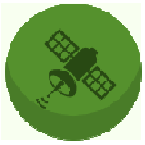
Structure of the Navigational window


Setting view
Swapping between bird's-eye view and 3D-view
Navigation
Navigation is made up of three main parts: navigation arrow, navigation distance and field border notification. Each information can be hidden on demand. The navigation arrow turns in proportion to distance, visually indicating to the user, how big corrigation is needed when steering.
Measuring results
Display of the set "devices".
Zoom
Setting zoom in and zoom out. In case of full zoom out, 80x120 m area becomes visible in the field of view, depending on device.
Setting point of view
In bird's-eye view, moving the camera's point of view. In 3D view, the camera can be turned with the help of buttons.
2D
3D
0,0 km/h
294,5 m
0,2 ha
1,06 m
Function buttons
Function buttons are hidden on the screen by default. They can be reached by tapping the button in the right bottom corner, or by pulling them from the right side of the screen.

Function-buttons description

In the navigation window there is only a small amount of buttons, to avoid confusion of the user, any specific functions (see list below) are invisible by default in a sliding layer. User can make it visible by tapping the right bottom button or can reach it by pulling it from the right side of the screen

Button image	***Description***
	Start button Guidancing can be started by tapping this button. Before tapping it, the path of the agricultural machine (or arrow) will be indicated by a thin line, after completing it, a thick line will show the cultivated area.
	Pause button This button is visible only if "Start button" has already been tapped. By tappingit, guidancing is paused. A pause flag will be placed on the field and an other navigation comes up to show the user how he/she can find back to this position. It can be used when the tank of the agricultural machine should be refilled at the edge of the field.
	"A" reference point button With this button the "A reference point" can be set (placed on the field).
	"B" reference point button With this button the "B reference point" can be set (placed on the

	field). The section between A and B point will be the reference line of the actual session, the navigation trajectory calculation is based on this section.
	Cultivated area hide / show button By tappingthis button the whole cultivated area can be hidden, and can be shown again, by tapping it again.
	Navigation arrow hide / show button By tapping this button the navigation arrow (plus the navigation distance, and field border alarm) can be hidden or visible.
	Satellite information button By tapping this button several information can be viewed about the state of the satellite connection. Such as: actual position, satellite in view, accuracy, etc. (This function is only available by using the Bluetooth DGPS antenna of **MachineryGuide** system.)
	Options button The Options menu is available from Navigation window as well, but in this case the preferencies are limited, because when a sessionis started, for instance the "allowed overlap", "center offset", "guidance mode" are no longer changeable.

	Exit button By tapping this button you can exit from the application. After the button is tapped, the software will ask whether you want to save the session or not.

Starting navigation (in case of A-B straight gudance mode)

Steps of starting navigation:

1. Go through the steps of ”Starting a new job session”.
2. If you have not reached the area you want to cultivate, drive the agricultural machine to the right position.
3. When starting cultivation, tap”Start” button.

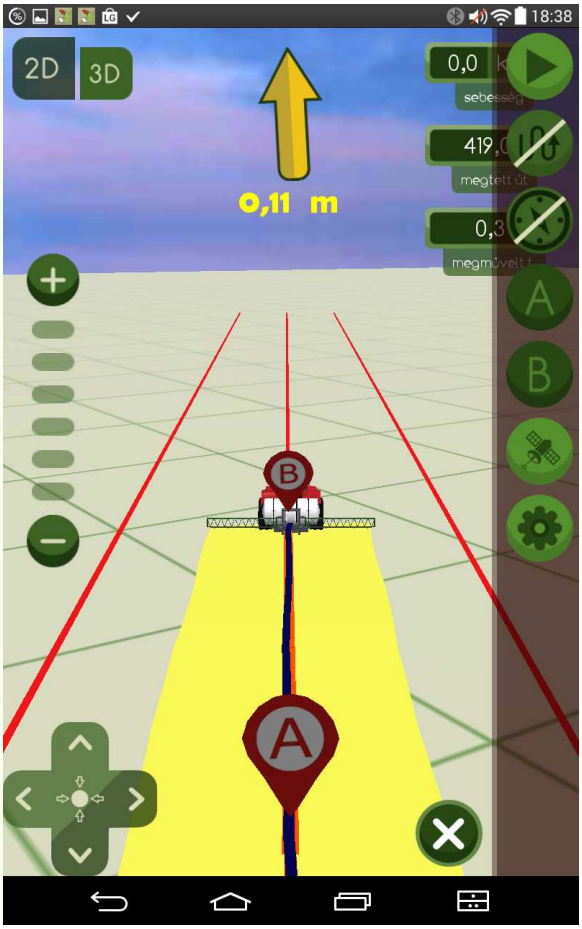
In case of A-B guidancing, the user of the program has to select a reference section, to which the navigation path (parallell lines) will be calculated.For setting the reference line, points A and B have to be placed.

4. Point out ”A” reference point, by tapping this button:

5. Drive forward. To place ”B” reference point you need to be at least 20 metres further from point ”A”. Until then, ”B” button is inactive.
6. Point out ”B” reference point by tapping this button:

7. Guidancing now has started. It can be interrupted any time by tapping the button, and be continued by tapping the button.

8. Go by the outlined navigation lines, follow the directions of the navigation arrow.
   Screen display, after placing A-B reference points:



Starting navigation (in case of AB with surrounding guidance mode)

Steps of starting navigation:

1. Go to Settings, tap Guidance mode option and choose AB with surrounding guidance mode.
2. Go through the steps of ”Starting a new job session”.

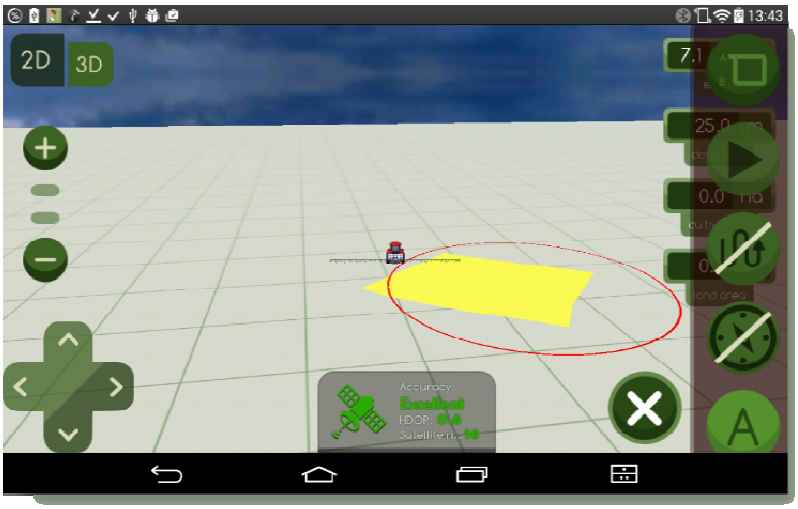
3. If you have not reached the area you want to cultivate, drive the agricultural machine to the right position.
4. When starting cultivation, tap”Start” button.

In case of AB with surrounding guidance mode, the user first has to go around the area, and give points A and B, based on which, the program outlines the A-B reference straight, and the straights that are parallel to it. You will have to move on these straights while guidancing.

5. Start to surround your field. While surrounding, point out ”A” reference point, by tapping this button:

6. Drive further and place ”B” reference point. You need to be at least 20 metres further from point ”A”. Until then, ”B” button is inactive.
7. Point out ”B” reference point by tapping this button:

8. A circle will appear at the starting point, indicating the place where you have to return after surrounding the field.



9. Guidancing now has started. It can be interrupted any time by tapping the button, and be continued by tapping the button.

10. Go by the outlined navigation lines, follow the directions of the navigation arrow. Arriving at the edge of the field, the following notification will appear in the application:

Further information:

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